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Pr9825 - Specification for Shafts

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Document Details

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Version Review

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9.0	Y Skinner	K Goraya	14/12/2023	Reformat & renumber to new technical specification template. Note that timeframes for submission of documents may be varied. Minor spelling errors	Periodic review Update to maintain consistent format over specifications
10.0	L. Bryson	N/A	N/A	Minor admin amend, no change to review dates.	09/09/2024 Minor amend to update superseded CoP with Mobile crane Code of Practice 2024 and format adjustments.

Contents

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1. Purpose

The intent of this Specification is to outline the minimum deliverables and standards that the contractor needs to comply with when constructing shafts/pits on Unitywater projects.

The purpose is to ensure consistency across all projects delivered by Unitywater and that the safety, quality, environmental and design objectives required by Unitywater are achieved.

2. Scope

This Specification defines the minimum technical requirements for shaft/pit construction works undertaken on Unitywater projects.

Shafts/pits are constructed to provide access below ground level which can be of permanent or temporary nature to suit the project requirements. A range of different shaft/pit construction techniques are available and will be selected to best suit the ground conditions and if applicable the trenchless construction methodology.

2.1 Order of Precedence

Where a discrepancy exists between the Drawings, this Specification and the other Unitywater specifications the Contractor shall seek clarification from the Superintendent's Representative.

This Specification shall take precedence over any other standard, code or guideline, but cannot diminish any requirement of a standard, code or guideline to which compliance is required by law within the jurisdiction of the work being performed.

All other applicable standards, codes and specifications referred to by documents that form part of this Specification shall also be followed.

2.2 Principal/Standard Drawings

Where the form of Contract is 'Design and Construct' the Principal Drawings are a high level concept design of the Principal's Project Requirements. The Contractor is to use these drawings as a guide to base the preliminary and final design upon. The Principal Drawings will typically illustrate the following elements:

- Site constraints
- Shaft/pit locations.

Alternatively, where the form of Contract is a construct only the Principal Drawings are a prescriptive representation of exactly what is to be constructed under the Contract. These drawings will include the minimum information that the Contractor will require to build the works. Any changes required or ambiguities found must be discussed with the Principal immediately.

3. Project Preliminaries

3.1 Approvals

Project approvals are usually controlled by Unitywater, however, in some instances approvals may be the responsibility of the Contractor. The Contractor is to refer to the Project Specific Scope of Works for required approvals.

No work is to begin on site preparation or shaft/pit construction activities until all relevant permits and approvals have been gained and signed off by the relevant authority. The following authorities may be required to authorise the works:

- Queensland Government Department of Transport and Main Roads
- Queensland Rail and/or other rail infrastructure owners
- Local Government
- Private land owners.

The Contractor shall be required to adhere to any approval conditions that the Principal or asset owner specifies.

3.2 Shaft/Pit Design

The Contractor shall be responsible for the design and construction of all aspects for the shaft/pit construction works including any temporary works. All design assumptions regarding subsurface conditions, equipment requirements, groundwater and other factors are the responsibility of the Contractor and shall be fully documented.

Based on the alignment shown in the Principal Drawings, the Contractor shall design and size the shafts/pits to accommodate all temporary and permanent works. The design is to be certified by a RPEQ engineer and shall be submitted to the Principal's Representative for review prior to commencement of work. The Contractor shall not proceed with any work until the Contractor's design has been accepted by the Principal's Representative. Acceptance of the Contractor's design by the Principal's Representative in no way diminishes the responsibility of the Contractor for the design.

The Contractor is responsible for submitting the following shaft/pit design elements for approval prior to commencing work:

- the design of all shafts/pits both temporary and/or permanent
- the type, size, depth and location of each shaft/pit shall suit site conditions
- the means of excavation and support for shaft/pit construction
- the design and execution of the shaft/pit construction equipment and processes
- the design of all temporary works associated with the shaft/pit construction
- where the permanent works are to accommodate shaft/pit construction, these shall be designed to ensure the permanent works are not damaged in operation
- collaboratively working with the Principal's permanent infrastructure functionality and permanent design team to ensure the intent of the overall project is achieved
- the shaft/pit construction sequence needs to conform to the established settlement and/or heave allowance
- any design amendments necessary to ensure that the construction techniques proposed are in compliance with the permanent design
- where ground anchors are required, it shall be demonstrated that they are a removable type anchor.

The shaft/pit design shall take account of all potential impacts on all existing infrastructure and underground features, including but not limited to impacts from ground movement, seismic activity, clearance to features, settlement/heave and any changes in the groundwater table resulting from the works, either temporarily during construction or permanently as a result of the construction.

All designs shall ensure the safe operation and use of plant, equipment and materials handling under all expected loadings such as ground pressure, superimposed loads and ramming or jacking forces.

Table 1 below outlines the required design drawings for the works under the Contract. It also details the RPEQ sign off.

Table 1: Design Drawing Requirement

Drawing Details	Plan / Elevation	RPEQ Sign Off
Site Layout	Plan	☐
Shaft/pit Construction	Plan + Elevation + Details	☑
Shaft/pit Layout	Plan + Elevation	☐

3.2.1 Shaft/Pit Types

Shaft/pit sinking shall be carried out by a method suitable for the site including geological conditions, hydrology, trenchless construction technique, depth and final purpose.

Shaft/pit construction methods may include the following:

- Sheet piling or secant piling
- Bored Piers and Shotcrete or Soldier Piles and timber lagging
- Shoring boxes/Trench Shields
- Battered/Benched excavation
- Jacked wet or dry caisson with steel, precast segmental concrete or cast in-situ lining
- Underpinned precast segmentally lined caisson
- Bolts, mesh and shotcrete.

All excavation work shall comply with the Unitywater Specification for Civil and Earth Works (Pr9902) in conjunction with the Queensland Code of Practice 2021 – Excavation Work. Excavation shall only proceed when the ground is sufficiently stable.

Where piling techniques are used best industry practice shall be followed as per AS2159 – Piling – Design and Installation.

Where shoring boxes are utilised best industry practice shall be adhered to as per AS47441 – Steel shoring and trench lining equipment.

Where work is done by a jacked caisson operation using precast concrete or prefabricated components a leading cutting edge may be required. These components shall be secured tightly and proven prior to sinking each stage.

When using cast in-situ caissons below the groundwater table the joints must be sealed sufficiently to limit groundwater inflow.

Where work is done by underpinning an adequately sized collar is required to support the hanging section until it is secured. One full unit of support shall be completed and secured prior to excavating the next stage. Preformed or precast rings shall be secured via grouting or similar prior to excavating the next stage.

Where an annular space is created through the shaft/pit method, it shall be properly supported with an engineering lubrication fluid (usually bentonite) or similar during shaft/pit sinking. On completion the annular space of the shaft/pit shall be filled and sealed using appropriate measures to correspond with surrounding geology (usually with grout).

Where ground anchors are used, each anchor shall be proof tested to 125% of the design working load, unless an alternate testing regime is approved by the Principal's Representative. All anchors shall be capable of being re-tested at any time as directed by the Principal's Representative.

3.2.2 Shaft/Pit Base

Shaft/pit bases shall be constructed and maintained to suit the temporary or permanent nature of the design. In the case of temporary shafts/pits the Contractor shall submit proposals for the shaft/pit base structure taking account of ground and groundwater forces and sealing the shaft/pit against water entry. Water pressure shall not be allowed to build up under shaft/pit bases until the shaft/pit has sufficient resistance or strength to prevent flotation. The construction sequence shall be approved by the Principal.

3.2.3 Temporary Works Design

The Contractor is responsible for submitting the design of all temporary works associated with shaft/pit construction. Temporary works design must be certified by an RPEQ Engineer.

This includes but not limited to the following:

- Temporary shaft/pit design
- Shaft/pit formwork
- Crane pads
- Access and egress
- Loadings within vicinity of the shaft/pit
- Backfill of temporary shafts/pits
- Retrieval of temporary shafts/pits
- Removal of ground anchors upon completing the works.

At all times shafts/pits shall be provided with safe primary and secondary means of access and egress. The Contractor shall take into account the effects of plant and equipment loadings within close proximity of the shafts/pits. At least one means of egress shall permit access for a stretcher and retrieval of an injured person.

3.2.4 Dewatering Management Plan (DMP)

Dewatering will only be permitted if the Contractor can prove that the effect of dewatering will not adversely affect the works, nor cause ground settlements exceeding the allowable limit, nor damage other structures or property.

The Contractor shall develop a Dewatering Management Plan (DMP) for approval prior to construction. Where dewatering spears are used or the effects of dewatering may impact nearby structures, this Plan shall be approved by a suitably qualified engineer (RPEQ). This Plan shall provide details throughout each stage of construction including but not limited to the following:

- dewatering method
- layout
- sump and pump locations
- expected groundwater flow rates
- predicted pump rates
- pump types and capacity including standby equipment
- treatment and testing procedure of groundwater
- emergency plan
- risk assessment
- predicted ground settlement
- discharge location and approvals
- any additional geotechnical and hydrogeological data required.

The Dewatering Management Plan shall be approved prior to commencing construction.

This shall be developed in conjunction with the Settlement Monitoring and Risk and Contingency Management Plans.

3.2.5 Design Collaboration

The Contractor and Principal shall collaboratively work to ensure that all shaft/pit design aspects have been adequately considered and analysed across the two key project phases: shaft/pit construction and the infrastructure's permanent operation.

3.3 Governing Documentation

As a minimum and in addition to the documentation required in the Contract documentation, the Contractor must submit for approval the following governing documentation as outlined in Table 2, Table 3 and Table 4 below:

Table 2: Work Plans

Plans	Submission
Settlement Monitoring Plan	4 weeks before work
Major Lift Plan(s)	1 week before lift
Plant Suitability and Maintenance Plan	4 weeks before work
Risk and Contingency Management Plan	4 weeks before work
Dewatering Management Plan	4 weeks before work
Shaft/Pit Construction Inspection and Test Plan	4 weeks before work
Noise and Vibration Management Plan	4 weeks before work

Table 3: Work Procedures

Procedure	Submission
Site Establishment	4 weeks before work
Shaft/Pit construction	4 weeks before work
Temporary shaft/pit retrieval or removal (if applicable)	4 weeks before work

Table 4: Safe Work Method Statements

Safety Work Method Statements	Submission
Operation of a crane/excavator	4 weeks prior to works
Work at Heights	4 weeks prior to works
Work in a confined or restricted space (if applicable)	4 weeks prior to works
Hot Works	4 weeks prior to works
Work at night under artificial light	4 weeks prior to works
Lifting	4 weeks prior to works

NOTE: These time frames may be varied either by written agreement or nominated in the Project Scope of Works.

3.4 Risk Assessment and Control

The Contractor is to prepare and implement an approved contingency plan dealing with the key project or shaft/pit construction risks identified. As a minimum the Contractor is to have defined plans complete with equipment and materials on standby to mitigate against the following shaft/pit construction risks:

- shaft/pit collapse
- shaft/pit flooding
- major equipment mechanical failure
- encroach on existing services
- settlement or heave scenarios
- damage to property
- working in proximity of suspended loads
- stormwater and surface runoff
- groundwater inflows
- serious safety or environment incidents.

The Contractor shall perform a risk assessment for each individual shaft/pit constructed.

3.5 Geotechnical Information and Risk

A Geotechnical Data Report (GDR) will be carried out by the Principal for the project and be provided to the Contractor. The report will cover a minimum set of requirements / criteria to aid and guide the Contractor to assess the project and specifically make informed decisions with regards to:

- equipment selection
- dewatering requirements
- shaft/pit type, construction methodology and size
- time and cost.

The level of geotechnical investigation shall be determined by, but not limited to the following inputs:

- proposed methodology
- local site geology
- local site hydrogeology
- project capital value.

The Contractor shall inform itself thoroughly and make its own deductions and conclusions as to the difficulty of maintaining required excavations and of doing other work affected by the geology and hydrogeology of the Site.

Where the Contractor considers it necessary that additional site or subsurface investigations are required, the Contractor shall bring this to the attention of the Principal's Representative in a timely manner.

4. Procurement

4.1 Approved Suppliers

The Contractor is to provide materials which have previously been approved for use as per the SEQ Water Supply and Sewerage Design and Construction Code Accepted Civil Products and Materials.

If the Contractor proposes to utilise non pre-approved products these are to be submitted to the Superintendent's Representative for consideration.

4.2 Principal Supplied Materials

The Contractor shall document the receipt of any Principal Supplied Materials formally with the Superintendent's Representative. The receipt of materials by the Contractor accepts the suitability of these products for inclusion in the Works.

All Principal Supplied materials shall be handled strictly in accordance with the manufacturer's written instructions at all times.

4.3 Storage and Security of Materials

The Contractor is to provide security for the Site and Works including the construction facilities, plant and equipment. Materials shall also be secured by the Contractor to prevent their removal by unauthorised personnel.

4.4 Personnel

Appropriately trained and experienced personnel are required for the delivery of the works. Details of key personnel experience shall be provided to the Superintendent's Representative for approval before the works commence.

A site supervisor who is thoroughly knowledgeable of the equipment and shaft/pit construction procedure is to be present at the job site at all times. The site supervisor is to be present to address immediate shaft/pit construction concerns, health and safety and environmental issues.

4.5 Plant

All shaft/pit construction operations shall be performed using specialist equipment. All plant and equipment must be of a good standard and the Superintendent's Representative shall be permitted to inspect the proposed plant. All plant must pass the Principal's equipment assessment/inspection criteria prior to site mobilisation. The key Principal's equipment assessment/inspection criteria are listed below:

- plant/equipment is required to be in good safe working order
- plant/equipment is required to have a good service history
- plant/equipment is required to be fit for purpose.

The Contractor's management plans and procedures must detail a system for daily checking and resolving of issues with the supplied plant and equipment. The Contractor must supply key critical spares to ensure that all the equipment achieves a 90% working availability target.

4.6 Materials

Permanent materials are to fully comply with this specification, the documents referenced herein and the relevant Australian Standard.

Materials used on site shall be used in accordance with the manufacturer's recommendations and instructions.

The Contractor shall prepare and submit material certificates for all permanent materials to be included in the works.

5. Project Execution

The Contractor shall maintain control of site operations at all times. The Contractor has ultimate responsibility for site safety, the environment, quality workmanship and the satisfactory completion of the work as authorised under the Contract.

5.1 Site Setup

The Contractor is to set shaft/pit sites up in accordance with the approved site layout drawing which, as a minimum, must cover the following key aspects:

- perimeter fencing in the allowed location
- site topsoil stockpile complete with erosion and sediment control
- entry and exit points
- pedestrian walkways and appropriate exclusion zones around cranes or moving plant
- equipment locations and movement zones
- any underground or overhead services and the appropriate exclusion zones
- shaft/pit location
- traffic guidance systems.

5.2 Existing Services

Existing services in proximity to the works shall have visual confirmation for location and depth. Shaft/pit locations shall be positioned to maximise cover between all services both above and below ground.

Existing services location and pot holing shall be included and detailed in the relevant ITP with hold points. The contractor shall also produce a procedure for locating existing services.

The Contractor shall note the presence of overhead and underground services on the works site. Special care shall be taken in the vicinity of electricity services. The locations of some underground services are indicated on the drawings and are based on information supplied by the respective Authorities where such information is available. It is emphasised that information supplied regarding these services is tentative only with respect to both details of services shown and the existence of other services not shown. Neither the Principal nor the Superintendent warrant the completeness or accuracy of the information given and the Contractor is required to make enquiries into the presence and location of underground services with the relevant Authorities.

The attention of the Contractor is drawn to the fact that private underground and overhead services and individual services to premises from public utility mains are not shown on the drawings. The Contractor shall verify the position of each underground service before commencement of excavation. The Contractor shall pre-locate the services as to depth, alignment and extent or size, so as to ensure such services are not adversely affected. Hand excavation may be necessary to close proximity to services until the exact location is determined.

For services that are owned by Queensland's Department of Transport and Main Roads, contact planroom@tmr.qld.gov.au for locations of DTMR's existing services.

For services that are owned by Queensland Rail refer to QR's web site, https://www.queenslandrail.com.au/forbusiness/thirdpartyaccess.

Trenches containing underground services shall be backfilled so that the subgrade is restored as nearly as possible to its original state of compaction.

Where selected backfill has been placed by other utilities and has had to be removed, it shall be replaced by the same type of selected material.

All backfill shall be carefully deposited in the trench and around the utility service in layers and adequately compacted by proper hand rammers and tampers or by use of effective mechanical equipment.

Extra care shall be taken by the Contractor to re-compact excavations near existing underground pipework, so that foundations of that pipework are restored and more especially when re-compacting in the vicinity of low flexibility pipework.

The Contractor shall be held responsible for any damage caused to existing overhead or underground services.

In case of failure or damage, the Contractor shall immediately notify the relevant service provider and arrange for repairs to be undertaken.

If there is any delay, the Superintendent will arrange for repairs to be carried out by the Principal or others and the full cost of such repairs shall be borne by the Contractor.

If, in the opinion of the Superintendent, the failure or damage causes an emergency situation, then remedial action will be taken by the Principal and the full cost of such action shall be borne by the Contractor.

Only those persons qualified to undertake repairs on the relevant services shall be permitted to perform the work with the prior approval of the service authority.

Where it is necessary to carry out alterations to existing overhead or underground services, this work will be arranged by the Contractor unless otherwise specified.

The Contractor shall allow to co-ordinate and work around service authorities where relocations are necessary during the Contract.

The Contractor shall promptly advise the Superintendent of any services affecting the works which were not shown on drawings so that appropriate action can be taken.

5.3 Dilapidation Reports

The Contractor is responsible for all pre-construction and post-construction property assessments. These assessments shall be a means of determining whether and to what extent, damage has resulted from the Contractor's operations during the Works. Any damaged identified shall be made good at the Contractors expense.

As a minimum the dilapidation reports shall capture:

- all work sites and any surrounding area likely to be impacted by the construction activities, including heavy vehicle traffic
- a minimum distance of 3x the depth of any shaft measured radially from its perimeter
- a minimum distance of 2x the depth to invert level measured from the centreline of any pipe installed by trenchless methods
- any area within the settlement trough or zone of influence as defined by the Contractors prediction of ground settlement.

The report must capture the condition of all aspects of the natural and built environment within the nominated areas, including but not limited to inside buildings, public utilities and plant, roadways and landscaping.

5.4 Monitoring and Reporting

A reporting and auditing schedule must be prepared as part of the approvals process prior to commencing the Works.

5.4.1 Daily Site Record

Records of all employees engaged on Site are to be maintained and be available for inspection by the Superintendent's Representative at any time. At each progress meeting the Contractor shall supply to the Superintendent's Representative a list showing the number of employees in the various trade categories.

Records are to be kept of all major plant items on Site. At each progress meeting the Superintendent's Representative shall be supplied with a list showing a description of the items of plant, hours worked, hours out of service and hours lost through weather during the preceding week.

Records shall be maintained describing the major works being carried out on Site for each day of the Works and be available for inspection by the Superintendent's Representative at any time (as per Table 5 below).

Table 5: Shaft/Pit Construction Reporting

Shaft/pit Construction Record / Report	Details
Shaft/pit Excavation Records	Daily
Geological Records	Daily
Ground Support Records	Daily
Environmental Details (water treatment, noise, dust and sediment controls)	Weekly and immediately if there is a problem
Plant, Labour and Materials Used	Weekly

5.4.2 Surface Settlement or Heave

Information on the permissible subsidence or heave at the ground surface shall be provided considering the use of the area, structures and systems in the sphere of influence of the project, taking into consideration the subsoil and groundwater conditions and the depth of cover.

5.5 General Earthworks

General earthworks requirements shall conform to the requirements of Unitywater's Specification for Civil and Earthworks (Pr9902).

5.6 Shaft/Pit Construction

All works are to be conducted within approved working hours. Any works requested outside of these hours shall be approved by the Principal's Representative.

All works shall be constructed in accordance with the relevant design drawings and standards. Any discrepancies shall be notified to the Principal's Representative as soon as practicable.

The Contractor shall have RPEQ engineer verification and inspection for all man access to the shaft/pit.

The Contractor shall adhere to AS2865 Confined Spaces when applicable. The Contractor shall appropriately follow AS2865 Confined Spaces Figure 1 process of defining if a work area is deemed to be a confined space and submit justification to Unitywater for approval.

5.6.1 Excavation and Shaft/Pit Support

Safety and security of excavations is the responsibility of the Contractor at all times during the execution of the Contract.

Prior to excavation, the shaft/pit area shall be checked for any existing services or structures as per Section 5.2.

Methods of excavation shall be provided to the Superintendents Representative for review and approval. Unless otherwise approved, the excavation sequence shall follow the drawings and specifications at all times.

The Contractor shall ensure that the ground is stable prior to excavating each stage. The Contractor shall guard against distortion of shaft/pit lining during construction and the possibility of shaft/pit settlement or uplift at an intermediate stage of construction.

5.6.2 Protection and Access

At all times shafts/pits shall be provided with safe primary and secondary means of access and egress. The Contractor shall limit working at heights during construction where practicable. Handrails and toe boards shall be installed around the shaft/pit perimeter for fall protection.

Access routes into site shall be clearly signed and maintained throughout the execution of the Contract. Safe designated pedestrian access shall be implemented and maintained throughout work site.

A system to record, identify and locate personnel in shafts/pits shall be developed and implemented by the Contractor where appropriate.

The Contractor shall provide shaft/pit safety covers (in addition to site fencing) when the site is unattended, unless approved by the Superintendent's Representative.

5.6.3 Dewatering

The Contractor shall adhere to the Dewatering Management Plan at all times as per Section 3.2.4. The Contractor shall implement best practice systems to control groundwater at all times. Removal of groundwater shall not cause damage to the works nor third party property. No water shall be discharged without the necessary approvals in place. A sufficient number of pumps and sumps shall be available for use and in good working order at all times to limit the risk of shaft/pit flooding.

5.6.4 Ventilation and Atmospheric Monitoring

A schedule of gases and pollutants to be tested including the frequency and method of testing shall be provided by the Contractor.

Shafts/pits shall be ventilated at all times to maintain an atmosphere fit for respiration and free from oxygen deficiency, toxic gases and dust. Ventilation shall also be used to maintain a safe working temperature. Ventilation ducts/bags shall be continuously extended during the immediate stages of excavation as required.

Atmospheric monitoring equipment shall be in good working order, calibrated and installed at all shaft/pit faces. Continuous monitoring shall be undertaken at the work front to ensure the quality of air is within acceptable limits.

Atmospheric monitoring shall be conducted and recorded regularly as agreed with the Superintendent's Representative. In an event of a ventilation failure or atmospheric alarm the workforce must be immediately evacuated and shaft/pit assessed prior to re-entering. Appropriate respiratory protective equipment shall be made available and used where required. Smoking is forbidden in shafts/pits and confined spaces at all times.

Dust suppression systems shall be readily available for use when required. Dust extractors shall be installed in conjunction with fresh air fans if required.

5.6.5 Noise and Vibration Monitoring

Construction methods shall be selected to minimise noise and vibration at all times.

Vibration regarding impact on critical structures shall be included in the relevant Contractor Shafts construction procedure.

Noise and vibration levels shall remain in compliance with the Queensland *Environmental Protection Regulation 2019* and Queensland *Environmental Protection (Noise) Policy 2019*.

Monitoring shall be conducted regularly with the results recorded and made available to the Superintendent's Representative.

Any plant and equipment exceeding the acceptable limits may be removed off site at Principals discretion.

Equipment such as large generators, liquid recyclers and pumps shall be fitted with suitable noise reduction enclosures. All mobile equipment shall be fitted with broadband type reversing "squawkers" where possible. Beeper type reversing alarms shall not be permitted for any night works or any use in residential areas.

5.6.6 Lighting

Lighting shall be adequate for the safe operation of all plant and equipment at the work fronts. in accordance with Safe Work Australia: Managing the Work Environment and Facilities Code of Practice.

An alternative lighting source shall be available or installed in the event of a power failure.

5.6.7 Temporary Shafts/pits

Backfill for temporary working shafts/pits shall comprise material approved by the Superintendent.

Temporary shafts/pits shall be RPEQ engineer certified and inspected.

Where the Contractor wishes to recover temporary shaft/pit linings the structure shall be removed in safe stages as backfilling proceeds, taking care to maintain the safety and structural integrity of the remaining lining.

Where a temporary shaft/pit is not retrieved, the Contractor shall remove all structure/s to a minimum level of 1.5m below the existing surface level or as otherwise agreed with the Superintendent's Representative.

All excess spoil shall be disposed of by the Contractor.

5.6.8 Construction Tolerances

All shafts/pits shall be installed in conformance with the horizontal and vertical alignment as shown on the drawings subject to the allowable construction tolerances as listed in Table 6 below unless otherwise detailed in the Project Specific Specification.

Table 6: Allowable construction tolerance

No.	Shaft/pit Types	Tolerance Type	Shaft/pit Diameter **< 5m**	Shaft/pit Diameter **> 5m**
1.	Grouted segmental lining:	Line and level	± 35 mm	± 50 mm
2.	Cast-in-situ concrete lining:	Line and level	± 35 mm	± 50 mm
3.	Sprayed concrete lining:	Line and level	± 30 mm	± 75 mm
4.	Bored / Secant / Soldier Piles	Line and level	± 50 mm	± 100 mm
5.	All other Shafts/pits	Line and level	± 50 mm	± 100 mm
6.	All Shaft/pit types	Verticality	1:200	1:200

Where the shaft/pit is out of alignment, based upon the tolerances tabulated below, excavation is to stop immediately. The excavation shall not recommence until directed by the Superintendent's Representative. The Contractor is responsible for all corrective works and associated costs needed to correct the alignment of the shaft/pit.

Under no circumstances shall the Contractor take corrective action without the approval of the Superintendent's Representative.

6. Project Completion and Handover

Throughout the construction phase of the project the Contractor is to complete and submit all records mentioned in the above sections of this Specification. In addition to these documents, the Contractor is to submit the as-built package in hard copy and electronic format.

The Contractor shall keep records of all operations and all such data as directed by the Superintendent's Representative. These records will form part of the As-Built data. As-Constructed details shall comply with the requirements of SEQ WS&S D&C Code – Asset Information Specification.

The Contractor is required to submit as-built records in CAD and ADAC format. The Contractor must also submit Red Line Drawings detailing all relevant as-built records.

All records are to be approved by the Superintendent's Representative and submitted in accordance with Unitywater specifications listed within the contract documentation.

6.1 Document Submittals

The Contractor shall liaise closely with the Superintendent's Representative during the documentation of survey work and shall provide the Superintendent's Representative with adequate opportunity to verify any measurement or detail the Contractor considers necessary prior to the commencement of reinstatement operations.

6.2 Post-Construction Dilapidation report

The Contractor is responsible for all pre-construction and post-construction property assessments. These assessments shall be a means of determining whether, and to what extent, damage has resulted from the Contractor's operations during the Works.

7. Typical Shaft/Pit Construction Inspection and Test Plan (ITP)

The Contractor shall prepare and submit for approval by the Principal at least four (4) weeks (or at the timeframe nominated within the Project Scope of Works) prior to the commencement of the shaft/pit construction works, an Inspection and Test Plan (ITP) for the works in accordance with the requirements of the relevant specifications.

Table 7 below detail the typical activities that trigger a visual inspection, witness point verification or hold point release. This list is to be used as a minimum guide for the Contractor to develop their ITP.

The Contractor must provide the Principal at least 8hrs (business hours) notice (or at the timeframe nominated within the Project Scope of Works) of a required visual inspection, witness point verification or hold point release.

Table 7: Inspection and Test Plan

		Contractor Responsibilities			Principal Responsibilities		
Project Elements	Activity	Visual	Witness	Hold	Visual	Witness	Hold
Project Documentation	Company HSEQ System	☐	☐	☒	☐	☐	☒
	Project Safety Plan	☐	☐	☒	☐	☐	☒
	Project Environmental Plan	☐	☐	☒	☐	☐	☒
	Project Quality Plan	☐	☐	☒	☐	☐	☒
	Project Traffic & Pedestrian Management Plan	☐	☐	☒	☐	☐	☒
	Plant Suitability and Maintenance Plan	☐	☐	☒	☐	☐	☒
	Dilapidation reports (pre- and post-construction)	☐	☐	☒	☐	☐	☒
	Noise and Vibration Management Plan	☐	☐	☒	☐	☐	☒
	Dewatering Management Plan	☐	☐	☒	☐	☐	☒
	Site Establishment Plan	☐	☐	☒	☐	☐	☒
	Settlement Plan	☐	☐	☒	☐	☐	☒
	Shaft/pit construction Procedure	☐	☐	☒	☐	☐	☒
	Lift Plans (Shaft/pit Plant & Equipment)	☐	☐	☒	☐	☐	☒
Design Documentation	Crane Pad	☐	☐	☒	☐	☐	☒
	Shaft/pit	☐	☐	☒	☐	☐	☒
	Groundwater Flow Predictions	☐	☐	☒	☐	☐	☒
	Settlement / heave Calculations	☐	☐	☒	☐	☐	☒
Project Execution	Site Set Up To Plan	☐	☒	☐	☒	☐	☐
	Existing services location and pot holing	☒	☐	☒	☐	☐	☒
	Crane / Excavator Pad Installation To Design	☐	☒	☐	☒	☐	☐
	Shaft/pit Mark Out To Design	☐	☒	☐	☒	☐	☐
	Shaft/pit Built To Design	☐	☐	☒	☐	☐	☒
	Concrete / Precast / grouting quality records (if applicable)	☐	☐	☒	☐	☐	☒
	Groundwater Monitoring and Review	☐	☐	☒	☐	☒	☐
	Settlement / Heave Monitoring and Review	☐	☐	☒	☐	☒	☐

Pr9825 - Specification for Shafts

		Contractor Responsibilities			Principal Responsibilities		
Project Elements	Activity	Visual	Witness	Hold	Visual	Witness	Hold
Commissioning and Hand Over	Red Line Drawing	☐	☐	☒	☐	☐	☒
	As Built Survey	☐	☐	☒	☐	☐	☒
	Submission Of All Project Records/SEQ WS&S D&C Handover Deliverables	☐	☐	☒	☐	☐	☒

Appendices

Appendix A – Definitions, Acronyms Abbreviations

The following definitions, abbreviations and acronyms are used throughout this specification.

Definitions

Term	Definition
Act	The *Work Health and Safety Act 2011* (Qld)
Auger/Thrust Boring	A technique for forming a bore from a start or drive shaft to a reception shaft by means of a rotating cutterhead. Spoil is removed back to the drive shaft by helically wound auger flights rotating in a steel casing. This equipment may have limited steering capability.
Angular Deflection	The amount of deflection, both horizontal and vertical that an enveloper may be expected to develop during the auger boring construction phase due to the limited steering capability of the auger cutter head.
Carrier Pipe	A pipe installed for the conveyance of water, gas, sewage and other products and services. In auger bored installations it is usually installed inside an enveloper pipe. The carrier pipe material/joint type to be determined by the degree of angular deflection of the enveloper pipe.
Contract	The legally binding agreement between two or more parties for doing or not doing something specified.
Contractor	An organisation that is bound to carry out and complete the works under the Contract.
Contingency Plan	A plan to mitigate the risk of an activity. The plan usually allows for backup procedures, emergency response and post-disaster recovery.
Drawings	Drawings prepared by the Designer(s) for the purpose of illustrating the design requirements for the works under the Contract.
Designer	A professional engineer (RPEQ) who is appointed by the Contractor to carry out design and to issue instructions regarding standards, specifications and techniques to be observed in the construction of the project.
Design Documentation	Drawings, specifications and other design documentation (including design standards, design or durability reports and calculations) in computer readable and written forms prepared by the Designer for the purposes of the trenchless works under the Contract.
Enveloper Pipe	Pipe installed by auger boring to house the carrier pipe.
Geotechnical Baseline Report (GBR)	The GBR describes the ‘Ground Reference Conditions’ at the location (alignment as shown in the GBR) of the proposed alignment. The Baseline Conditions presented in GBR represent what is assumed to be encountered for the purpose of defining “indications of the Contract”. The provision of a baseline in the Contract is not a warranty that the baseline conditions will, in fact, be encountered. It is therefore not appropriate for the Principal or Contractor to conclude that baseline statements are warranties.
Ground Loss	Ground loss is defined as the volume of material that has been excavated in excess of the theoretical design volume of excavation.

Term	Definition
Launch pit or shaft	An excavation at the commencement point of an auger bore, in which the jacking structure and other equipment is installed and from which the auger boring operations are carried out.
Lift (shaft / pit)	The incremental construction height completed as the shaft/pit progresses downward.
Operator	Suitably trained or qualified person who operates machinery, an instrument, or other equipment.
Permit	A document that controls an activity that is considered high and not able to be commenced without completing important requirements.
Principal	For infrastructure being delivered as Unitywater funded and managed projects, **Unitywater.** For developer donated infrastructure being delivered under an approval issued by Unitywater Development Services, the **Developer's Principal Consulting Engineer** (RPEQ, suitably qualified and experienced).
Principal Drawings	Drawings issued to the Contractor forming part of the Contract. These drawings are owned by the Principal and are to be used to guide or govern the work under the contract.
Project Manager	A person nominated by the Contractor responsible for the construction of the contract.
Red Line Drawings	Original, as constructed drawings marked up in red detailing the as-built data.
Safe Work Method Statement	A document summarising the work required for an activity. This document summarises the hazards and the required measures to control and minimise safety risk.
Scope of Work	A document summarising the works to be completed under the Contract.
Specification	This document, that specifies, in a complete, verifiable manner, the requirements, design, behaviour, or other characteristics of a system, component, product, result or service and often, the procedures for determining whether these provisions have been satisfied.
Superintendent	An individual appointed by the Principal to perform two functions: Be the Principal's agent for the works under the Contract. Administer the Contract fairly and perform certain certifier requirements.
Superintendent's Representative	A person nominated by the Superintendent, to act on behalf of the Superintendent
Trenchless Construction	Installation of new or replacement of underground infrastructure with minimal disruption to surface environment, traffic, business, and other activities.

Abbreviations and Acronyms

Acronym	Description
ASTT	Australasian Society for Trenchless Technology
AS/NZS	Australian / New Zealand Standard
ASS	Acid Sulphate Soils
AS	Australian Standard
BYDA	Before You Dig Australia https://www.byda.com.au/ (Important: Department of Transport and Main Roads and Queensland Rail are not members of BYDA)
CAD	Computer Aided Design
CCTV	Closed Circuit Television
GBR	Geotechnical Baseline Report
GRP	Glass Reinforced Plastic
HDPE	High Density Polyethylene Pipe
ID	Inside Diameter
IFC	Issued for Construction
ISO	International Standards Organisation
ITP	Inspection and Test Plan
NATA	National Association of Testing Authorities
N/A	Not Applicable
OD	Outside Diameter
QA	Quality Assurance
RPEQ	Registered Professional Engineer Queensland

Appendix B – References

General

All work carried out under this Specification shall comply in all aspects (i.e. in design, construction, testing and performance) in accordance with the:

- South-East Queensland Water Supply and Sewerage Design and Construction Code (SEQ WS&S D&C Code) including:
    - SEQ WSA 02 – Sewerage Code of Australia
    - SEQ IPAM List (SEQ approved Infrastructure Products and Materials List)
    - SEQ Asset Information Specification.
- Unitywater's Technical Specifications, including but not limited to:
    - Pr9903 - Specification for Building and Structural Works
    - Pr9902 - Specification for Civil and Earthworks
    - Pr9787 - Specification for Microtunnelling and Pipejacking
    - Pr9789 - Specification for Auger Boring
    - Pr9790 - Specification for Pipe Ramming
    - Pr9693 - Specification for Mechanical Installations
    - Pr9821 - Specification for Reservoir Design and Construction.
- The latest relevant Australian (AS), British (BS) and IEC Standards
- Standards in the following sections.

Reference to specific clauses of the various codes is intended to highlight those points and shall not be taken to imply a lesser importance for all other applicable clauses.

All the works shall conform to the Rules and Regulations of the Statutory Authorities having jurisdiction over the Site.

If the requirements of this Specification do not articulate with the minimum requirements of the statutory regulations and standards, the regulatory requirements are taken to apply. If the requirements of this Specification are more exacting than the minimum requirements of the statutory regulations and standards, the former shall apply.

All Materials, fittings, accessories and equipment supplied by the Contractor shall be new and the best obtainable of their kind and shall comply in all respects with the requirements of the relevant Standards Australia specifications.

Applicable Legislation and Regulation

At least the following legislation and related regulation shall apply:

- *Work Health and Safety Act 2011* (Qld)
- *Work Health and Safety Regulation 2011* (Qld)
- *Water Supply (Safety and Reliability) Act 2008* (Qld)
- *Environmental Protection Act 1994* (Qld)
- *Environmental Protection Regulation 2019* (Qld)
- *Environmental Protection (Noise) Policy 2019* (Qld)
- *Queensland Building and Construction Commission Act 1991* (Qld)
- *Professional Engineers Act 2002* (Qld).

Codes of Practice (ratified by Legislation)

SEQ Water Supply and Sewerage Design and Construction Code

The SEQ Water Supply and Sewerage Design and Construction Code (SEQ WS & S D & C Code) is available via the SEQCODE website: www.seqcode.com.au.

The requirements of the South-East Queensland Water Supply and Sewerage Design and Construction Code (SEQ WS & S D & C Code) shall supersede the requirements of this specification where advised in the project Scope of Works. In this case the requirements of this specification shall only apply where no requirement is provided in the SEQ WS & S D & C Code.

If the project Scope of Works does not reference SEQ WS & S D & C Code, the requirements of SEQ WS & S D & C Code shall apply where no requirements are stated in this specification.

Other Codes of Practice that apply to works carried out under this Specifications are:

- Managing noise and preventing hearing loss at work Code of Practice 2021, WorkSafe Qld
- Confined Space Code of Practice 2021, WorkSafe Qld
- Scaffolding Code of Practice 2021, WorkSafe Qld.

Quality and Standards

Unless otherwise specified, the equipment covered by this Specification shall be designed, manufactured, installed and tested in accordance with the following, listed in order of precedence:

- The Project Contract documents
- Requirements of the Statutory Authorities having jurisdiction over all or part of the manufacture, installation or operation of the plant
- The SEQ WS&S D&C Code
- All relevant Australian and governing Queensland standards where applicable
- Water Services Australia (WSAA) National Codes.

In the absence of relevant SEQ WS&S D&C Code, WSAA or Australian codes or standards, relevant industry, international (ISO), European or British standards shall be followed. International standards shall take precedence over European or British standards. The Contractor shall obtain approval from the Superintendent prior to using any non-Australian standards not nominated in the equipment specifications, schedules, datasheets or associated drawings.

Where local or international standards do not exist, the manufacture and installation of equipment shall be in full compliance with the manufacturer's own recognised standards. Manufacturer's standards, where used, shall be submitted to the Superintendent by the Contractor for review and acceptance shall be obtained by the Contractor from the Superintendent prior to commencement of manufacture.

All equipment shall comply with relevant Federal and State Acts, Regulations and Codes including, but not necessarily limited to, the following:

- *Work Health and Safety Act 2011* (Qld)
- *Work Health and Safety Regulation 2011* (Qld)
- Work Health and Safety Queensland Codes of Practice, including but not limited to:
    - Managing noise and Preventing Hearing Loss at Work Code of Practice 2021, WorkSafe Qld
    - Excavation Work Code of Practice 2021, WorkSafe Qld
    - Confined Spaces Code of Practice 2021, WorkSafe Qld
    - Formwork Code of Practice 2016, WorkSafe Qld
    - Mobile Crane Code of Practice 2024, WorkSafe Qld
    - Scaffolding Code of Practice 2021, WorkSafe Qld
    - Hazardous Chemicals Code of Practice 2021, WorkSafe Qld
    - Tilt-up and Pre-cast Construction Code of Practice 2003, WorkSafe Qld
    - Steel Construction Code of Practice 2004, WorkSafe Qld.

The version of any applicable standard or regulation shall be the revision in place at the date of invitation of contract packages.

The Contractor shall have in place a dedicated quality system that conforms to ISO 9001.

Quality control procedures for management, inspection, review and evaluation of all materials, manufacture, workmanship and testing of all products shall be planned and implemented by appropriately skilled and qualified persons to ensure that requirements of the quality procedures are met and that high quality is maintained.

The Contractor shall ensure that all equipment supplied/installed under this Specification is the product of a manufacturer who is fully experienced, reputable, qualified and regularly engaged for at least five years in the manufacture of the equipment to be supplied/installed.

Industry Guidelines

At least the following industry guidelines shall apply:

- Australasian Society for Trenchless Technology (2015) Specification for Microtunneling and Pipe Jacking, Rev 2, June 2015
- Australasian Society for Trenchless Technology (2015) Specification for Microtunneling and Pipe Jacking, Rev 2, June 2015
- Australasian Society for Trenchless Technology (2010) Specification for Horizontal Directional Drilling, Rev 2, Feb 2015
- Safe Work Australia Guide for Tunnelling Work 2013.

International and Australian Standards

Standard	Title
Quality Systems	
AS 2990	Quality Systems for Engineering and Construction Projects
AS 3901	Quality Systems for Design/Development, Production, Installation and Servicing
AS 3902	Quality Systems for Production and Installation
AS 3903	Quality Systems for Final Inspection and Test
Materials and Workmanship	
AS 2887	Plastics Waste Fittings
AS 3500	Plumbing Code of Australia
AS 3706	Geotextiles – Methods of test
AS 4373	Pruning of Amenity Trees
AS 4799	Installation of underground utility services and pipelines within railway boundaries